Leibniz Institute of
Ecological Urban and
Regional Development

IMPACT

International Conference on Managing Protected Areas under Climate Change

Book of Abstracts

24 - 26 September 2012
Dresden / Germany

HABIT-CHANGE adaptive management for protected areas
CENTRAL EUROPE COOPERATING FOR SUCCESS.
EUROPEAN UNION EUROPEAN REGIONAL DEVELOPMENT FUND
This project is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF

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HABIT-CHANGE
adaptive management for protected areas.

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Welcome

to the International Conference on Managing Protected Areas under Climate Change (IMPACT)

Climate Change and anthropogenic activities are challenging habitats and their management. Especially protected areas are confronted with the pressing need to monitor changes, adapt management strategies and consider flexible responses to future developments. IMPACT sets out to meet the growing need for sharing knowledge and experiences in the field of biodiversity conservation and climate change. Taking a trans-disciplinary perspective, the aim of the conference is to bring together researchers, conservation managers and decision-makers in the field of nature conservation. It provides a platform for dialogue to develop a better understanding of the complex impacts of climate change on biodiversity on local level and the means to adapt management in protected areas accordingly.

Climate change and the development of robust adaptation strategies are the key challenges of conservation management of the future. Climate smart conservation requires continuous adaptation to changing climate and its ecological consequences. Inter- and trans-disciplinary research on cross-cutting themes is needed to provide mutual learning between all actors and the development of effective strategies. These are also topics of the project 'Adaptive Management of Climate-induced Changes of Habitat Diversity in Protected Areas' (HABIT-CHANGE), in which framework this conference is organised.

We wish all participants successful, communicative and inspiring conference days!

Dr. Marco Neubert and Dr. Sven Rannow

On behalf the entire HABIT-CHANGE project team and the
Leibniz Institute of Ecological Urban and Regional Development (IOER)

This project is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF

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Keynote Speeches

"Is biodiversity law adapted to climate change adaptation?" by An Cliquet, Department of Public International Law, Ghent University

25 September 2012 – 09:00 a.m.

Climate change will cause further loss of biodiversity and can cause further deterioration of protected areas. Adaptive measures are required to protect biodiversity from the effects of climate change. At the international and European policy level, attention is paid to the link between biodiversity and climate change. Within the framework of the Biodiversity Convention, several decisions were taken by the Conferences of the Parties. The EU policy on climate change and biodiversity aims at improving a coherent ecological network in order to have more resilient ecosystems and to provide for connectivity outside the core areas. An important question is, if biodiversity law is sufficiently adapted to face these additional challenges for biodiversity conservation.

International biodiversity conventions to not deal with climate change issues specifically. However, within the subsequent decisions in the framework of these conventions, attention is given to climate change. The legal value of these decisions is however debated. Stronger legal obligations can be found within EU legislation. The existing legal framework, the Birds and Habitats Directives can enable adaptive measures, by establishing and managing the Natura 2000 network and providing for connectivity measures. However, the implementation of the legal instruments have so far mainly been aimed at conservation the status quo of habitats and species within the core areas. In order to face the additional negative effects of climate change, efforts must be increased to protect ecosystems from the negative effects from climate change, and to facilitate ecological restoration of new areas. Even more effort is needed for the implementation of the connectivity. Although the existing legal framework is not ideal, it certainly provides – be it often implicit – legal possibilities for restoration and connectivity measures.

Prof. Dr. An Cliquet *holds degrees in Law and Maritime Sciences. In 2001 she became Doctor in Law on the subject of "Nature conservation in the marine and coastal environment, with specific reference to the Belgian marine and coastal environment." She is an expert on public international law, as well as international and European biodiversity law.*

"Global Sustainability Policy and the Science-Policy Interface: Is There a Role for Ecosystem Models?" by Wolfgang Cramer, Institut Méditerranéen de Biodiversité et d'Ecologie marine et continentale

24 September 2012 – 11:00 a.m.

There is no longer a question about the need to integrate the conservation of biodiversity and the assured provisioning of ecosystem services with other aspects of sustainability policy such as energy and climate. The debate now rather revolves about tradeoffs, synergies and conflicts between these different elements. For conservation, for example, protected areas are one option, the integration of conservation goals into long-term land use policy another. Both ends of this gradient have their respective merits, and both need to be considered quantitatively with respect to overall sustainability objectives. At the onset of work of the Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES), there are numerous open science questions that need to be addressed by researchers during coming decades. For a number of them, well-validated ecosystem models can be a suitable tool for the testing of scenarios of future drivers and conditions.

***Prof. Dr. Wolfgang Cramer**, environmental geographer and plant ecologist, is the head of research at IMBE, the Institut Méditerranéen de Biodiversité et d'Ecologie marine et continentale, in Aix-en-Provence, France. Until 2011, he was co-leading the "Earth System Analysis" area of research at the Potsdam Institute for Climate Impact Research (PIK). Prof. Dr. Cramer received his academic training in Germany (diploma in Geography at Giessen University, 1981) and Sweden (Ph.D. in plant ecology at Uppsala University, 1986). Prof. Dr. Cramer is a current member of several scientific committees, such as DIVERSITAS and ICSU's Ecosystem Change & Society.*

"Climate Change and NATURA 2000: the need for vision and action" by Rob Jongman, Wageningen University

24 September 2012 – 11:30 a.m.

Climate change is leading to changes in environmental conditions for humans and natural species. This means changing environmental processes in natural and semi-natural habitats as well in agricultural land. The speed of change in as well as the location of natural areas requires not only the knowledge on ecological processes and ecosystem change, but also the effect that this is having on societal and economic processes and patterns.

Changes in natural systems caused by climate change do take place due to changes in abiotic processes and in biotic processes. This means that average and extreme temperature can change, that precipitation can change in quantity and in pattern, causing drought or flooding and rivers may change their seasonal character due to these changes. Based on these changes habitats might change such as a higher upper tree level or a drier pre-desert zone in south-east Spain.

This will have an impact on species that are favoured by changing conditions or that cannot cope with the changing conditions. Mountain top vegetation is already changing; natural areas in lowlands face the inherent change that might make them uninhabitable for the species that live there now. Some marine species are moving north, changing the character of marine life. On the other hand migrating species might cease migrating as storks do already in Spain.

We have to identify a strategy to maintain the quality of N2000 sites if possible, and help species to move through a landscape if needed. Both require changes in nature, land and water management. We have to adapt the definitions in our Directives and Conventions, solve legal problems and get social acceptance of climate change impacts. All this requires a coherent and inviting vision for the European nature of the near future and clarity on the position of NATURA 2000 and other protected areas in it.

Dr. Rob Jongman *is a landscape ecologist and expert in river ecology, nature conservation planning, as well as environmental monitoring. Dr. Jongman is a senior researcher at ALTERRA, which is part of Wageningen University & Research centre. He holds a Ph.D. from Wageningen University in landscape ecology. Since 1990 he has worked on a concept of ecological networks at the European level as a strategy for nature conservation planning. His current projects focus on biodiversity monitoring. Together with Biodiversity International and NASA he is running the GEO biodiversity Community of Practice GEO-BON. Furthermore, he is the coordinator of the European pilot project on biodiversity monitoring EBONE.*

This project is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF

"Science and society: the context for developing conservation adaptation strategies" by Mike Morecroft, Head of Profession for Climate Change, Natural England

25 September 2012 – 16:30

Conservation science has been considering climate change adaptation for almost as long as it has been researching the impacts of climate change. The science has, however, developed rapidly in the last 10 years and it is timely to review some of the basic tenets of adaptation. At the same time climate change adaptation has become an important policy area and strategies have been developed at international, national and sub-national scales. Adaptation is a challenge for all of society to address and developments in other sectors may be just as important as what happens within the conservation sector. There are significant opportunities to develop ecosystem-based adaptation in, for example, flood risk management and the design of urban areas. However, there are also threats presented by 'unsustainable' adaptation in other sectors. I will therefore review the scientific principles for climate change adaptation in the light of recent research and consider the opportunities and threats presented by the wider adaptation agenda.

In this context, what are the key challenges for European conservation? What should be the balance between national and European initiatives? Protected areas will continue to be an essential component of successful conservation in a changing climate, but we will need to understand their changing role in a a broader context.

Dr. Mike Morecroft *is the head of profession for Natural England's work on climate change. He is an ecologist, specialising in climate change impacts, adaptation and mitigation. Prior to joining Natural England in 2009 he led a research group at the Centre for Ecology and Hydrology (CEH) at Wallingford, England. His Ph.D. (Cambridge, 1990) research was on the way plants change with altitude on mountains and interactions between climate and nutrients supply. He is a Senior Visiting Research Associate at Oxford University's Environmental Change Institute and currently involved with the development of the National Adaptation Programme for Climate Change.*

Sessions

Assessing Sensitivity

Kothe, Miriam: "Vulnerability assessment for a protected area in Germany – from theory into practice"

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The assessment of vulnerability of ecosystems towards climate change as a basis for the adaptation of management is a widely discussed approach in nature conservation, but a commonly accepted and tested method to determine ecosystems vulnerability doesn't exist yet.
For a bachelor thesis in environmental planning the suitability of the methodological approach for a protected Natura 2000 site in Brandenburg Germany was tested. The goal of the study was to determine whether the vulnerability assessment can be of practical relevance for the adaptation of management strategies in the protected area.
The study area "Rambower Moor" is a peat bog that contains 8 protected habitat types. It is located in the federal state Brandenburg within "Flusslandschaft Elbe – Brandenburg Biosphere Reserve".

The implemented vulnerability assessment is based on a broad analysis of the study area and a literature review. According to the IPCC, vulnerability is seen as a product of (1) exposure to climate change, (2) sensitivity of the ecosystem and its constituents towards climate change and (3) the adaptive capacity of the human and natural system. Existing data and methods were used to determine these three components of vulnerability for the study area.

The assessment of future exposure to climate change was based on regional climate data published by PIK (2009). Climatic water balance and soil moisture are the most significant indicators and indicate a high exposure to climate change. The sensitivity of the habitat types was determined by using two different indicator-based approaches. Although generally a high sensitivity of the water-dependent habitat types can be assumed, both approaches lead to different results in detail.
To assess the adaptive capacity of the protected area, relevant criteria such as personal and financial capacities of the administration and the contact to stakeholders were identified and information was retrieved via interviews. High exposure to climate change, high sensitivity of the habitats and a low adaptive capacity result in a high vulnerability of the study area.

The relevance of the vulnerability assessment for management were discussed and recommendations for the adaptation of the study area were developed. These include changes of the land use and water management. The study shows that the practical use and implementation of vulnerability assessments is limited by the lack of up-to-date data, the lack of knowledge about climate change impacts on habitats and the existing gap between the scientific approach and practical advice for the adaptation of management.

Lupp, G.; Heuchele, L.; Wachler, C.; Pauli, P.; Konold, W.; Siegrist, D.: "Strategies for tourism to adapt to climate change and protecting biodiversity - Case studies from protected areas in different German landscapes"

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Outdoor recreation depends on biodiversity, which is threatened by climate change, land use changes, but also by tourism. Key challenges for the future of these destinations are to develop strategies to protect biodiversity and adapt to climate change issues. The Biosphere Reserve "Südost Rügen" (coastal areas), the Nature Park "Feldberger Sennlandschaft" (North German lowland, lakes), the Large Protected Area "Feldberg-Belchen-Oberes Wiesental" in the Black Forest (Mountain areas) and the Large Protected Area "Allgäuer Hochalpen" (Alpine areas) serve as model outdoor recreation regions to cover all important German landscapes.

In our work, we analyze the perception of different regional key stakeholders from recreation, nature protection, planning, local authorities, land managers, forestry, agriculture and regional development institutions what actions might be necessary to halt the loss of biodiversity and to react and/or adapt to climate change from their point of view. We select interviewees by choosing key stakeholders from different institutions and contrasting opinions using guided interviews. In the next step, we start to initiate a communication process in the model regions by bringing together these different stakeholders to get them involved to take action. For this, we organize workshops in the model regions by using World Café, Focus Groups and Open Space as methodological approaches. Key stakeholders are invited to discuss and develop their own ideas for co-operation and taking action.
Finally, initiatives and cooperation are examined and reflected together with key stakeholders in all regions to find out success models and promising approaches for reacting to those challenges. Finally, we reflect these across all different four regions to find out the most promising strategies and best practice examples for all regions to protect biodiversity and to get active in climate change issues.

Nusko, N.: "Climate change in Northeast Germany – estimating its risks for ecosystems"

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The federal state of Brandenburg in NE-Germany will be significantly affected by climate change. Projections of regional climate models predict a continuing increase of average daytime temperature, especially in winter. Longer periods of drought and more frequent extreme weather events are set to occur (Linke et al. 2010). Even now the region is characterised as relatively dry with a low annual precipitation and mainly sandy soils, why the status of the landscape water budget is critical (Holsten 2009). The effects of climate change in combination with other stresses like pollution, landscape fragmentation or land use change will lead to a much higher stress on biodiversity in the future. Resulting changes in the interaction in complex systems (e.g. ecosystems) may lead to a modification of the biocoenosis and the change of the whole system. How fast changes will emerge is regionally different depending on the resilience, respectively the vulnerability of ecosystems and their compartments (IPCC 2007). As Vulnerability results from the interaction of any

change in exposure, particular sensitivity, as well as specific adaptive capacity (IPCC 2007), some elements of biodiversity will be more affected than others.

Regional Estimations of risks caused by climatic changes are therefore of great interest. The University of Applied Science Eberswalde (Germany) works within the joint research project INKA BB (Innovative Network for Climate Change Adaptation Brandenburg Berlin) to contribute to that issue.
To estimate the Vulnerability of ecosystems to climate change referring to a specific landscape context, our working group is developing a method to identify areas of equal reactions towards climate change in Brandenburg.
The method is based on a spatial analysis of regional climate change projections and potentially effective system parameters in landscape units.

By using different regional climate change scenarios for Brandenburg (= direct exposure) combined with data of regional groundwater levels, soil properties (e.g. storage capacity, capillary water rise) and relief we assess the indirect exposure within the landscape units.

In order to assess the impact on ecosystems, we use the estimation of changes of the abiotic elements in the system (= indirect exposure) as basis for the risk evaluation of its biotic components.

For the differences of ecosystems sensitivity and adaptive capacity, we need to figure out:

1. Which structures are particularly sensitive and which system functions are affected?

2. Which structures exists to buffer the disturbance by sustain its functions?

First results for Forest- and Mire-Ecosystems already exist.

Sarbu, A.; Anastasiu, P.; Smarandache, D.; Pasacle, G.: "Sensitivity of plants with a high conservation value to the effects of climate change"

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The current paper reveals new information concerning the potential sensitivity of some plants with a high conservation value (rare, endangered, endemic etc.) in Bucegi Natural Park, in regard to the expected pressures and effects of climate change.

The data presented in this paper is the result of the field research carried out in 2010 -2011 within the framework of the project HABIT-CHANGE – Adaptative management of climate-induced changes of habitats diversity in protected areas, which is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF. For the purpose of this study, six types of Natura 2000 habitats were selected: 6230* - Species-rich Nardus grasslands, on siliceous substrates in mountain areas, 6170 – Alpine and subalpine calcareous grasslands, 6150 – Siliceous alpine and boreal grasslands, 9110 – Luzulo-Fagetum beech forest, 91V0 – Dacian beech forest, 9410 – Acidophilous Picea forests.
As a result of the floristic evaluation, 65 taxa were identified (41 taxa in grassland habitats and 24 in forest habitats) with high conservation value at national level, out of which, 19 taxa are also listed for conservation at European and global level.

For all of the above mentioned taxa, the life forms and the ecologic categories they belong to were identified, which reflect the preferences of these plants in terms of edaphic humidity and/or air temperature.

The results obtained highlighted the fact that the vast majority of the taxa evaluated (over 90%) are potentially sensitive to the increase of air temperature and/or the reduction of edaphic humidity, and that the differences between the two groups of habitats are very small. Over 50% of the taxa are sensitive to the cumulated effects of these factors. In order to survive, these taxa require simultaneously low temperatures, sufficient humidity and the protection of snow. The other studied taxa are usually sensitive to only one of the factors and only a few of them are potentially resistant. The decline and eventual extinction of these plants of great conservation value, visibly endangered by the consequences of climate change, diminish to a great extent the quality of the habitats and of the respective protected area, created with the purpose of protecting these plants. Thus, through the current study, the authors would like to draw attention to this genuinely great danger and to nominate a series of taxa from the alpine and mountain area of the Bucegi Mountains, which are evaluated as being significantly vulnerable to the effects of climate change.

Walmsley, C.; McCall, R.; Wilson, L.: "Identifying adaptation priorities using a Climate Vulnerability Index within the protected area network in Wales"

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Climate change has been identified as one of the key future drivers of biodiversity change within Wales and the UK. There are more than 1000 protected areas across Wales. It is vital to identify those sites where the risk of climate change impacts is greatest in order to focus adaptation action and improve resilience.

The vulnerability of protected sites to climate change impacts is dependent upon inherent site characteristics, such as the types of habitats and species features present, and their sensitivities to climate; site management issues, including the conservation condition status of the features and any interaction of climate change with management measures; and the ecological connectivity of the site within the landscape.

A Climate Vulnerability Index (CVI) was developed by bringing together existing Welsh habitat survey and protected area databases to provide site data along with habitat fragmentation analysis to determine connectivity of habitats within each site. The combined Index was not weighted because of the likelihood that weightings should be site or habitat specific: however, further consideration may be given to this in future. The ranking of the sites by their CVI score suggests that aquatic and coastal sites are generally more vulnerable. Many of the sites with the highest vulnerability have already been identified as being at high risk of impact from climate change, and on several actions are already being developed, and these will be outlined. These independent assessments of site vulnerability help corroborate the value of the Index in providing a means of identifying sites where conservation management plans should be urgently reviewed to take account of climate change. Further conservation management planning is now underway as a result of this work on sites which had not been previously identified as particularly vulnerable to climate change.

Current and Future Management Practices

Ausden, M.: "Climate change adaptation on RSPB nature reserves – putting theory into practice"

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I will describe the systems which RSPB uses to plan and implement measures to adapt to climate change on its network of nature reserves in the UK, and show examples of practical adaptation action that we have taken.

Long-term, strategic aims of the network are defined in the RSPB's Reserves Conservation Strategy. This includes network-wide targets for habitat quality, populations of key species, and land acquisition. These take into account a range of factors including the predicted impacts of climate change.

Each nature reserve has a management plan. This contains information on UK Climate Projections (UKCP09)-derived projected changes in key climate-related variables (such as potential soil moisture deficit and numbers of growing days), assesses how key habitats and species may be affected by projected changes in climate, and uses these to inform the site's long-term (generally 25-year) vision and five-year objectives. Progress towards achieving each site's objectives is audited and reviewed annually. Information from across all sites is also collated to assess annual progress towards achieving the network-wide objectives. Individual site management plans are reviewed every five years.

These systems enable us to plan, implement and review management interventions on different timescales, at both network and site levels. They allow us to:

1) Adapt management gradually at sites for types of actions which have short-term implications, or which take only a short time to realise their conservation benefits e.g. grazing of grasslands by livestock.

2) Plan and implement actions now, which have long-term implications, or which take a long time to realise their conservation benefits. Because of uncertainties over the timescales and impacts of climate change, we focus on measures with the greatest chance of having current and future benefits, and minimal adverse impacts on biodiversity, under all plausible future climate scenarios.

For the second half of the presentation, I will provide brief examples of the adaptation actions we have implemented: re-creating intertidal habitat to compensate for areas lost through coastal squeeze; re-creating freshwater wetlands inland to compensate for projected saline flooding and loss of coastal freshwater wetlands; addressing pressures on freshwater supply for wetlands in Southern England; maintaining sites in good condition and increasing their size through habitat creation, including linking patches of high quality habitat. I will also describe how developing partnerships between organisations is helping develop adaptation on our nature reserves.

Beger, M.; Sommer, B.; Harrison, P., Pandolfi, J.: "Managing and conserving coral reefs under climate change"

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The world's oceans contain one of the habitats most threatened by climate change, coral reefs that harbour most of the tropical marine biodiversity. Climate change will pose multi-dimensional threats to tropical reefs, including rising water temperatures, ocean acidification, and higher physical stress from wave and wind force extrema. I will discuss these threats, as well as potential management options using the example of subtropical reef transition zones. Biogeographical transition zones are at the forefront of climate change and function as evolutionary adaptive centres while undergoing community re-assemblage. Subtropical reef transition zones occur where tropical, subtropical and temperate biogeographic provinces overlap, and have been highlighted as potential refuges for tropical coral reef species. This role gives them high conservation priority, yet management strategies are currently not embedded in the ecological framework of transition zones. Climate change conservation options include passive management strategies such as no-take reserves that aim to minimise local disturbances, and active strategies such as relocating populations to refuge sites. Existing subtropical marine reserves may be ineffective in dealing with climate change threats, necessitating larger no-take areas with narrower spacing under the precautionary principle. Active intervention would require environmental conditions that support long-term persistence of relocated populations, but some subtropical populations may not persist once source populations are locally extinct. Stringent protection of suitable reef habitat is the most promising avenue to facilitate the recruitment of new tropical species while acting as stepping stones for their migration and survival, as well as preventing loss of endemics. Throughout the presentation I will discuss environmental decision making strategies in the light of the differences and commonalities among tropical, subtropical and temperate reefs, as well as terrestrial systems where appropriate.

Bisca, V.; Ivanov, G.; Doroftei M.: "Adaptive Management for Danube Delta Biosphere Reserve in climate change context"

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Danube Delta Biosphere Reserve Authority (DDBRA) is a public institution subordinated to the Romanian Ministry of Environment and Forests, responsible for the management of reserve.
Its main objectives are set out in order to strengthen the management capacity:

- The DDBR natural heritage preservation (biodiversity and renewable natural resources).
- The sustainable development model of local communities through the renewable resources using in the natural ecosystems carrying capacity limits.
- Knowledge development about deltaic phenomena, research and monitoring activities for a better understanding of the evolution tendencies in order to adopt the appropriate management measures.
- Environmental education and public awareness development about the natural heritage values by involving the stakeholders in its adaptive/precautious management process.

DDBRA strategies are part of the management plan that deals with the problems of preparation, planning and development of the operations set to achieve the proposed goals.

The Master Plan regards the integration of the actions for each problem identified in a global strategy that ensures the synergic realization of all the actions to achieve the proposed objectives and goals. The Master Plan's measures of success are given by the implementation of the proposed actions.

Since 1991, DDBRA, DDNI and some Romanian specialized universities have developed researching strategies for environment protection, biodiversity, monitoring, evaluation of natural resources and sustainable development, but less on climate changes.
The objectives included in the management plan are not achieved entirely, due to a lack of real knowledge on climate change effects, although at national level are laws in accordance with EU legislation.
Concerning the climate changes research, they were included into the DDBRA Master Plans yearly as important objectives by developing several projects tangentially.
Apart from the other research activities, presently DDBRA and DDNI focus on research regarding alien and invasive species impact on biodiversity, climate change, monitoring of different determinant indicators of climate change based on relevant historical data and putting adaptation strategies into action.
DDBRA has become more aware of climate change causes and effects and it has been developing new management strategies and environment policies to stop the biodiversity decline and to preserve the natural heritage. The most recent example is the amending and supplementing its special Law 82 in order to mitigate the climate-induced change impact within DDBR.
One of the most important projects is HABIT-CHANGE implementation which plays a crucial role for DDBR adaptive management in the climate change context.

Kreft, S.; Geiger, L.; Nowicki, C.; Ibisch, P.; Reichle, S.; Renner, I.; Hobson, P.: "MARISCO – an adaptive conservation planning instrument designed for the proactive management of climate change risks"

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Protected areas continue to be the most important instruments for conserving global biodiversity. Nevertheless, biodiversity keeps declining in the face of negative impacts from unchecked human development. In addition, the effects of climate change are contributing to the disruption and degradation of ecosystems, including those under protection. Current scientific thinking embraces principles of non-equilibrium ecology that recognizes uncertainty and advocates dynamic change in preference to conventional theories and practices of steady state ecology. Moreover, non-linear and highly dynamic socioeconomic and political changes from local to global scale affect biodiversity and challenge protected area management. Adaptive management is specifically structured to take account of uncertainty and indeterministic change by optimising learning through planned and documented action. Nonetheless, adaptive management can also be strongly reactive, in that it responds to the changes detected in a system. Its use in combination with proactive risk

management should make it more complete and effective. Existing strong adaptive management approaches to conservation, in particular the Conservation Measures Partnership's Open Standards for the Practice of Conservation, can serve as the basis for the analysis and adaptive management of vulnerabilities.
MARISCO (Spanish acronym meaning Adaptive risk and vulnerability management at conservation sites), is a modified version of the Open Standards that includes new elements to the ongoing process of analysis and planning. It is designed to evaluate biodiversity and environmental problems at a large scale based on the following approaches:

1. focus on ecosystem attributes and change dynamics,
2. visualise complex situations in conservation sites of any type and size,
3. facilitate adaptive and proactive planning and strategies,
4. promote a realistic and nuanced vision and planning scheme regarding the manageability of relevant threats, and
5. improve on existing strategies by a comprehensive evaluation procedure and develop complementary strategies.

MARISCO emerged and developed during workshops and projects carried out in Germany, Ukraine, China, Costa Rica, Guatemala and Peru. Protected area managers acknowledge that MARISCO helps create a new 'culture' of adaptive and creative team work. Part of its strength is the awareness it brings to stakeholder groups about the complex dynamics of existing as well as future threats relating to both climate change and other anthropogenic pressures, and of the particular vulnerabilities bound to biodiversity. Ultimately, a more appreciative understanding of the threats to biodiversity is achieved amongst conservation managers that lead to improved strategies for dealing with non-knowledge situations and uncertainties.

MacGregor, N.; Van Dijk, N.: "How are the managers of conservation areas in England adapting to climate change?"

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The effects of climate change are already apparent in a wide range of ecosystems, and potentially severe effects on biodiversity and ecosystem function could occur in the future. Managers of conservation areas will need to take action to help the natural environment adapt in a world that appears likely to be much more dynamic and unpredictable. This presents a significant challenge, as it will be necessary to identify and implement appropriate actions, for specific areas at specific points in time, in the face of great uncertainty about the timing and magnitude of possible climatic changes and their consequences for complex natural systems.

To help develop appropriate strategies and approaches for addressing this challenge, there is potential to learn from the ways in which the managers of conservation areas are already starting to consider adaptation to climate change. In many cases the approaches they are taking are likely to build on past experiences of coping with natural fluctuations in the environment, and could provide a foundation for considering and evaluating future adaptation options.

We are investigating how the managers of conservation areas in England are approaching adaptation. We have studied two contrasting parts of the country – the flat and low-lying region of East Anglia in eastern England and the more mountainous areas of Cumbria, the North Pennines and the Yorkshire Dales in the northwest. We have used a questionnaire and semi-structured interviews to collect information from the managers of a range of different conservation areas, containing a variety of different ecosystem types. Topics we are investigating include: the impacts of climate change that conservation managers in different areas perceive to be of greatest importance in relation to their existing conservation objectives; the adaptation goals that are being set and the management actions that are being carried out to achieve these goals; sources of information used; and barriers to taking action. We have used the information collected to identify some major themes and issues that are apparent across the different sites in our study. We have found that, although uncertainty about the future is a significant issue, adaptation is already being considered in some detail in many conservation sites, and the approaches that are being taken could provide some useful lessons for future action.

Roye, C.; Oxford, N.: "Management Practices Towards Increasing Resilience of Coastal Ecosystems to the Impacts of Climate Change in selected Marine Protected Areas in Jamaica"

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The Jamaican economy is heavily dependent on the country's natural environment and particularly upon its coastal resources. The coastal zone contains approximately 75% of industries and service sectors and is responsible for generating approximately 90 % of the island's GDP. Additionally, more than 60% of Jamaica's population resides within 2 km of the coast, with the majority either reliant on, or affected by coastal activities. Due to its geographic location (within the Atlantic Hurricane Belt), Jamaica is particularly susceptible to cyclonic activity and accordingly faces direct threats from climate change.

Coastal ecosystems - coral reefs, sea-grass beds, and mangrove forests play a pivotal role in providing natural coastal defence mechanisms to the impacts of climate change such as hurricanes, flooding and storm surge. These coastal resources are areas of high primary productivity, contributing significantly to the fisheries, sediment stabilization as well as carbon sequestration. The overall ecosystem function particularly that of defence capabilities, have been compromised largely due to anthropogenic degradation which increases susceptibility and retards resilience to natural disasters. This is further compounded by inadequate institutional capacity for implementation, monitoring and strategic interventions.

The Government of Jamaica (GOJ) received funds from the European Union (EU) for the Implementation of the Climate Change Adaptation and Disaster Risk Reduction Project. The National Environment and Planning Agency (NEPA) is implementing a component of this project with expected critical success factor to; increase the resilience of selected coastal areas against potential climate change impacts. This is to be achieved through adaptive management strategies, including restoration of mangrove forests, seagrass beds and coral reefs within marine protected areas (MPAs). This is primarily geared towards reducing risks associated with storm surges, sea level rise, saline intrusion and threats to livelihoods, and thus will have many social and economic benefits.

Among the results will be the strengthening of the institutional capacity to better manage these coastal ecosystems. This includes the development of coastal ecosystems database; restored mangrove forests and seagrass beds; improving management/organization by assisting with development of MPA management plans; demarking MPAs by installing marker/mooring buoys; identification of and training in alternative livelihoods for resource users; installation of artificial reefs to enhance existing coral ecosystems; and installation of sea temperature data loggers geared towards early warning systems. These strategies are intended to increase Jamaica's coastal capacity to adapt to the impending changes that will result from and that are currently occurring as result of climate change.

Ziemba, J.: "The Maldives and the rethoric of the "sinking paradise." Different approaches t the issue of the country's disappearing due to climate change"

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The global warming and environmental change introduced the whole range of new issues into the world. Institutions like IPCC or UNDP provide statistical data of their social consequences. It seems that the problem is widely addressed, however, some sensitive data of great social importance are still missing in the debate.

An example of such data result from the difference in perception of the situation displayed by governments and the common people. Current debate shows that danger of mass migration due to devastation of natural environment is one of the most appalling effects of global warming. One of the most vulnerable areas are low lying countries and coasts. One of them are Maldives, the lowest lying country on the planet with average 1,5 m. above sea level. If the temperature rises as predicted and cause the sea level rise, Maldives will completely disappear by the end of this century.

However, this pressing social problem seems to strike international audience more than Maldivians themselves. The authorities blame biggest world economies for global warming effects and claim that mass migration to neighboring countries may be inevitable. At the same time, Maldives were announced to become the first carbon dioxide-free country in the world to provide an example for other countries how to be ecological. This may be a challenge since the Maldives are having trouble dealing with the side effects of industrial development.

In order to achieve complex and realistic picture of the current situation in the Maldives I am using an interdisciplinary approach. It combines already existing data from ecology and climate science and sociological fieldwork (observation and in-depth interviews) in order to collect some extremely sensitive data.

First part of the research revealed that the perception of the flooding situation is much weaker on the side of the common people than their officials. One of possible explanations may be that Maldivian authorities want to attract tourist using "sinking paradise rhetoric". Common Maldivians are more aware of dangers and possibilities of newly acquired democracy than environmental threat, which they don't really believe in.

Introducing sociological methods into the research on climate change may help to understand on-going changes in the societies around the world and expose a spectrum of possible issues in the future.

Modelling of climate-induced Impacts

Anders, I.: "The challenge of connecting climate model output and climate observations to impact research"

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The society, policy, economy and environment request information on changes in the climate during the last years and especially in near and remote future. Estimation and quantification of changes in climate variables and indices are a necessary precondition for adaptation and mitigation measures.

Meteorological measurements tell us something about the past and recent climate. Due to the fact that the Earth's surface contains complex terrain of mountain peaks, small scale valleys, plains and plateaus, cities with urban heat islands, littorals, glaciated and forested areas, deserts and other landscape features the demand for data sets appropriate to study long-term climate variability are very high. It has become obvious that "ancient" measurements are not directly comparable with today's modern networks: Station locations, observers and instruments have changed, and many series contain gaps which have to be completed. Especially World War I and II damaged meteorological networks in Europe disastrously. Many stations had to be closed and many of the existing original climate sheets got lost. Data recovery initiatives contribute to a reduction of that deficiency and thus an enhanced knowledge of regional climate variability.

For the future only climate models help us to estimate the possible changes in climate parameters. It can be distinguished between two main approaches. One group are the dynamical climate models containing the most important physical processes describing our climate system. Their spatial resolution varies from 3° down to 1.2° for Global Climate Models (GCM) and 50 down to 3km (0.5° - 0.025°) for Climate models calculating the climate on a regional scale (RCM). The second group of climate models follows the statistical approach. Statistical relationships between large scale processes and local measurements are transferred into the future climate and changes can be derived very locally. Dynamical and statistical models both have advantages and disadvantages. The decision what kind of climate model to use is dependent on the application and the specific question to be answered in relation to future climate change.

Examples will be presented connecting information on future climate change derived from climate models and impact models.

Hartley, A.: "Quantifying the reliability of General Circulation Models for biodiversity impacts studies"

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Studies of the impact of climate change on biodiversity frequently rely on projections from General Circulation Models (GCMs). These models are intended to be used for the simulation of large scale processes in the earth system for the purposes of understanding the climate system, its sensitivities and feedbacks. However, when using the results of GCMs for projecting the future impacts of climate change on biodiversity, relatively little attention has been paid to the uncertainties in the production of climate data used in such studies. For example, it has previously been noted that there are significant mismatches between the spatial scale of such models, and the scales necessary for practical conservation planning. Local or regional scale processes may also be missing from such models, and models may be biased to consistently over or underestimate certain variables, consequently casting doubt on their ability to reliably project changes of these variables into the future. The downscaling methodology itself may also introduce errors at scales relevant to conservation planning. This study tests the reliability for biodiversity impacts studies of a multi-model ensemble of GCMs produced for the Intergovernmental Panel on Climate Change 5th Report (IPCC AR5). We do this by comparing each model to 3 different observational datasets for the period 1950-2000. As the basis for comparison, we test the ability of the models to reproduce climate indices that are relevant for assessing or monitoring biodiversity. These include indices such as the date of start of the growing season, timing of peak precipitation or temperature, or length of dry season. Furthermore, we identify how simple interpolation-based downscaling techniques may introduce local or regional scale errors that can be important for conservation planning, particularly in heterogeneous landscapes. Finally, we present the results in relation to protected areas in order to provide conservation planners with the most appropriate advice on uncertainties in GCMs used in biodiversity impacts studies.

Luedeling, E.: "Climate change impacts on temperate perennials – knowledge gaps and the potential for unexpected results"

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Many studies have shown that temperate trees and other perennial species have responded to recent climate change with advances in spring phenology. Does this trend affect all species? And will it continue into the future?

A closer look at past results indicates that not all species have responded to warming in a similar way. For some species, phenology has even been delayed over a period of temperature increases. Even for species with advancing phenology over the past decades, more detailed analysis of the effects of warming during different parts of the year indicates that phenology-advancing effects are often restricted to only some months during spring. During different times, probably coinciding with winter chill accumulation, warm temperatures can delay phenology. Partial Least Squares regression offers the possibility to explore such intra-annual variation in the effects of warming. This method has recently been used to show that walnut bloom in California, cherry bloom in Germany, perennial

grasslands of the Tibetan Plateau and a large array of species in the United Kingdom responded to warming in at least some parts of the winter with delayed phenology.

Only Tree Rhododendron, a non-deciduous perennial, responded with advancing phenology to warming during all winter months in Nepal and China. In most locations, the delaying effect of winter warming is overridden by the bloom-advancing effects of spring warming, but vegetation on the Tibetan Plateau responded with a net delay in phenology, over a 25-year period of strong warming. Similar effects have been observed at high latitudes elsewhere. Quantifying effects of climate change on winter chill, and the responses of perennial species to such changes, could substantially enhance our ability to project climate change effects on such species. Such projections, however, are constrained by deficits in our understanding of dormancy-breaking processes. Horticultural scientists are probably the most advanced in modeling winter chill due to the importance of this factor for commercial fruit and nut production. Yet all models that exist are crude and empirical, and they differ substantially in their sensitivity to warming. While some combinations of such chilling models with forcing models are somewhat able to reproduce observed bloom dates, they are not very credible for application outside the climatic domain that they were developed in. Evaluation of climate change impacts on temperate trees requires a much better functional and quantitative understanding of relevant physiological processes than is currently available.

Mezosi, G.; Blanka, V.: "The regional differences of wind erosion hazard due to the changing climatic conditions in the Carpathian-basin"

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One of the greatest natural hazards in the Carpathian Basin is the wind erosion. The occurrence and the extent of the damage are controlled by many factors (e.g. soil texture, lithology, climate, vegetation, anthropogenic factors etc.). The volume of the wind erosion hazard can be explained by the unconsolidated sandy and silty sediments, covering about 60% of the Basin and the varying intensity of plant cover caused by arable farming.

The currently existing potential wind erosion map is estimated the surface sensitivity to wind erosion using soil characteristics and the critical wind speed. During this research a new sensitivity map was generated for the Carpathian Basin using the Wind Erosion Equation. The newly created map in accordance with the WEQ uses wider sources of information, thus it can provide more detailed information. The wind erosion was calculated by the USDA standard formula and the Klik's modification, but in a country wide scale, not in plot size.

This sensitivity map was the input data for the future wind erosion hazard assessment. The aim of the analysis was to predict the location, period and volume of the hazard, induced by wind erosion. Between the critical parameters of wind erosion soil properties, orography and lithology can be considered as invariant in the timescale of the analysis. Conversely land cover and type of management can change extensively, which can be hardly predicted. The most important, predictable factor is the climate change. For assessing the climate change precipitation, temperature and wind speed data, derived from REMO and ALADIN regional climate models were used for two future periods (2021-2050 and 2071-2100). The scale of the analysis was defined by the spatial resolution of the models (about 25 km)., Thornthwaite index (using averaged monthly precipitation

and temperature data for the periods) and averaged monthly wind speed data was calculated for the climatic factor of the WEQ. As a result of the assessment a map was produced indicating the volume of wind erosion hazard and the potentially endangered areas in the periods of 2021-2050 and 2071-2100 assuming the present soil properties, orography and the A1B emission scenario. The map, provided by this analysis can demonstrate the critical areas; therefore it can be applied in spatial planning to create more optimal land use, land management and agrological techniques (e.g. increasing roughness or planting shelter belt) in order to eliminate the increasing wind erosion hazard.

Pearce-Higgins, J.; Dodd, A.; Johnston, A.: "Projected changes in bird populations within Special Protection Areas (SPAs): implications for land management and policy"

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Protected areas are a key tool for conservationists to protect vulnerable species and habitats. One of the most successful has been the Special Protection Area (SPA) network. However, projected future changes in bird distribution are expected to significantly reduce the effectiveness of this network, leading to considerable debate about the climate change implications for land management and conservation policy.

We model future changes to the abundance of Annex I and migratory bird species across part of the SPA network. The results are used to identify the sites and species in the UK for which the greatest change is projected and make key suggestions for policy. A review of the habitat requirements of these species identifies land management measures which may be required to maximise the resilience of individual sites to climate change.

Models had fairly low predictive power when used to describe current spatial variation in density between sites. This indicates that site quality is currently more important in driving between-site variation in abundance than climate. Management to improve quality may therefore increase the resilience of sites and populations to climate change. There was a significant correlation between recent national population trends for each species and projected vulnerability to climate change, suggesting that populations were already responding to recent change. Projected future changes suggested by 2050 that more species may achieve current SPA qualifying status at more sites in the UK than are likely to lose status, although increasing severity of climate change through time will increase the number of losses. Declines were projected to be greatest in some northerly distributed breeding species and seabirds and significant northwards latitudinal shifts in species assemblages were projected. Large sites will continue to support internationally important populations of species.

Management to maintain suitable habitat conditions for Annex I and migratory species in a changing climate is also likely to increase suitability for projected future colonists. Priority actions were identified and include habitat re-creation, improved and modified management of existing sites, and reduction of various external pressures. From a policy perspective, the results suggest the climate change will require SPAs to be better managed, bigger and possibly better connected to maximise their long-term effectiveness.

Skøien, J.O.; Dubois, G.; Schulz, M.; Hartley, A.: "Using species distribution models for predicting climate change of protected areas"

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Species distribution models (SDM) based on the Mahalanobis distance [1] or Maxent [2] are commonly used for predicting the suitability of the future climatic conditions taking climate change into account. Such models create a niche based on the values of the climatic variables at locations where a certain species has been observed. However, these models have been used to a lesser extent for predicting the future suitability of protected areas (PA). One reason is that protected areas rarely include all possible climatic conditions for the species currently living in the PA, and future suitability is therefore easily underestimated.

Using the Mahalanobis distance method as an example, we will here discuss different possibilities for using SDMs for predicting the future suitability of protected areas. Starting with the naïve approach, where we just use gridded climatic observations within the park for defining the niche, we will present and discuss some pros and cons of three other approaches:

1) Using expert knowledge for defining a minimum width of the niche
2) Using predicted ranges of species observed within the PA
3) Using time series from Global Circulation Models (GCM)

The first two approaches will use climatic forecasts that have been downscaled from the large scale pixels of GCMs (available from the WorldClim data base [3]), whereas we will use the model predictions from GCMs directly in the last approach.

The intention of this work is to present methods that can be used for assessing the climatic pressure on a large number of parks in the future, an information that could be used for comparing park suitability. Some of the methods are already available through our Web Service eHabitat (http://ehabitat.jrc.ec.europa.eu/).

Wagner, I.; Förster, M.; Anders, I.; Frischbier, N.; Falusi, E.; Janauer, G.A.; Malatinszky, A.; Sarbu, A., Zebisch, M.: "Relating growing seasons, exposure and sensitivity of habitats to climate change to derive potential impact maps in Central Europe"

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While exposure of natural vegetation to climate change (CC) can provide very detailed information on future temperature and precipitation conditions via climate models, the relation of these conditions to the sensitivity and potential impact of habitats is still unexploited on large scale.

The proposed study aims to link Pannonian, Continental and Alpine investigation areas and their specific response to CC. Local experts were asked to assess the sensitivity of their habitat types (according to the Habitat Directive) depending on changing temperature and precipitation conditions during the four growing seasons. Furthermore, the experts provided local species lists per habitat

types, which were used to calculate indicator values based on regional indicator schemes (e.g. Ellenberg for Continental region). These indicator values were used to bias the expert-knowledge.
The exposure for an investigation area was also split into four local growing seasons. Climate parameters like temperature values, precipitation and consecutive days without rain were supplied from climate model ensembles for the time steps of 1971-2000 and 2036-2065. The difference between these two time-steps were calculated per season and subsequently categorized into the magnitude of exposure based on the overall variance of the of the ensemble outcomes.

Finally, a transition table combined the values from the sensitivity assessment with those from the exposure categories derived from the climate parameters into an overall potential impact per growing season and habitat type.

Results from the investigation areas show that the breakdown into the growing seasons permits a more differentiated image of potential impacts than the maps would provide when the whole mean year is shown. This gives local stakeholder the possibility to change and adapt management practices in relation to the growing season. Although the approach is based on the local expert-knowledge it is biased by incorporating habitat demands based on the species list into the sensitivity of the habitats. Moreover, the separation of seasonal potential impacts gives more realistic insights in the potential impact due to climate change.

Climate Change Impacts on Species and Invasive Species

Ivajnsic, D.; Kaligaric, M.; Gomboc, S.; Sovinc, A.: "Sea-level rising, derived by the climate change and its impact on Natura 2000 coastal habitats in two Northern Adriatic protected areas"

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Climate change already became an important driver, which is going to influence habitats and their biota in the next decades. Sea-level rising is a simple climatic parameter, which shows clear trends in the last decades, especially during the last years. Thus, it is relatively simple to predict future scenarios. Due to sea-level rising, many seacoast habitats, containing rare and vulnerable halophyte vegetation, will be flooded in near future in the Mediterranean. Together with human-induced threats to the seacoasts (urbanisation, tourism, industry), sea-level rise will decrease the surfaces of endangered Natura 2000 coastal habitats and change their plant species composition. This will affect also animal species, especially those, whose life-cycle depends on specific plants (butterflies).

Habitat mapping of Slovenian seacoast habitats (Northern Adriatic) within the two main coastal protected areas (Sečovlje salina and Škocjan inlet) was performed and micro-elevation ranges of each habitat were obtained. A high positive correlation between the micro-elevation levels (measured with LiDAR technology calibrated with geodetic high resolution GPS module and – alternatively – with classical geodetic measurements) and the vegetation types (mapped according to PHYSIS habitat typology with a resolution of 2m2) were found. In all scenarios there was a decrease of a

habitat with Salicornia-dominated annual vegetation colonizing mud and sand. The habitat with halophyte perennials (Limonium angustifolium, Sarcocornia fruticosa, Atriplex portulacoides) will start to establish at the sites with appropriate micro-altitude according to the modelled scenarios. Similar shifts were predicted also for single butterfly species, linked to specific habitat types. In the worst-case scenario (sea level rise of 20 cm) the halophyte perennials are moving close to the dikes and forming a narrow zone where the elevation, soil moisture and salinity ratio represent appropriate growing conditions and the annuals almost disappear. Countermeasures shall include creation of artificial islets on proper elevation (a); creation of a buffer zone at the edge of a wetland zone (b); and artificial regulation of seawater influx with the dykes and channels (c).

Noroozi, J.: "The alpine flora of Iranian mountains and its sensitivity to climate change"

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The alpine habitats of Iran have a scattered distribution over the major mountain systems of country and lie almost above 3000 m a.s.l. up to 4800 m a.s.l. Iranian mountains have a transitional situation between Anatolia/Caucasus and the Hindu Kush/Himalaya, but with a strong own element with high endemism and remarkable relict species. Near to 700 alpine vascular plant species are known in these habitats and more than 50% of them are endemic and subendemic to Iran, mostly with narrow geographical distribution. The outstanding rate of high-altitude endemism appears to result mainly from orographic isolation of the country's highly scattered cold areas and by the absence of extensive Pleistocene glaciations. Predicted climate warming may seriously threaten the survival of the cold-adapted flora of Iran, due to a very low potential of alternative low-temperature habitats at higher elevations. Additional pressure through drought-tolerant competitors from lower altitudes can further increase the risk of biodiversity losses. According to climatic data from local meteorological stations, the temperature has been increased and precipitation decreased during the recent decades. To study warming-induced effects on alpine biodiversity and vegetation patterns, two long term monitoring station according to GLORIA standard approach (www.glorai.ac.at) have been established in high mountains of Iran.

Riordan, P.; Shi, K.; Wang, J.; Hughes, J.; Wang, W.: "Patterns of human land use in mountainous China in response to climate change and the impacts on endangered snow leopard populations."

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The global range of the endangered snow leopard (Panthera uncia) coincides with the major mountain ranges of Asia, occurring in 12 countries. Sensitivity to climate change in this mountainous region is causing significant impacts on ecosystems and human social and economic activities. Of the estimated 5,000 snow leopard remaining in the wild, the distribution of available suitable habitat suggests that more than half occur in China. As a top predator, snow leopards act as an umbrella species and provide an indicator of ecosystem health. Here, we draw on field studies carried out

This project is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF

across China since 2008, bringing together data on both snow leopard and their prey and on human socio-economic activity and land use. We combine these field data with broader economic and policy information for this region, along with ecosystem changes from remote sensing. Our findings show that anthropogenic responses to climate change in this region are complex at the level of local communities, and that policy interventions by national and local government exert variable influence across the snow leopard range. Livestock grazing pressure has tended to increase in its intensity and spatial extent in response to land opportunities and lengthening season through climate change. This pattern appears now to be altering in response to policy interventions, though not uniformly. Snow leopard natural prey populations, principally blue sheep (Pseudois nayaur) in this study, respond negatively to environmental degradation from increased livestock grazing pressure. This in turns appears to negatively affect snow leopard populations. However in parts of the range there are also resultant impacts on rates of livestock depredation, reportedly by snow leopard and other predators such as wolf (Canis lupus), potentially increasing persecution pressure on snow leopard populations. From this work we show that there are both complex direct and indirect impacts of climate change on snow leopard populations. Direct effects operate through ecosystem changes and increased human pressure. Indirect effects are felt through the increased conflict with people and greater risk of persecution. By furthering our understanding of these complex interactions, we hope to highlight vitally important considerations that need taking into account for conservation action planning for snow leopard in China and across their range.

Šajna, N.; Kaligarič; M.; Ivajnšič, D.: "Reproduction biology of a drought-tolerant invasive Aster squamatus from the Northern Adriatic coastal protected areas, Slovenia"

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To understand changes in biodiversity, we must take into consideration at least the effects of global warming like increased summer drought, the shift in plant phenology with the lengthened vegetation period, and the possibility that alien species might benefit from them. Aster squamatus (Sprengel) Hieron. is a hemicryptophyte originating from central South America occupying habitats like salt marsh landscapes from Central Argentina. Even though A. squamatus does not usually form large dense stands in introduced habitats, the species is distributed widely in many European countries, among them Italy, Spain, France, Malta, Cyprus, and Greece. First record of A. squamatus in Slovenia was noted in 1973 and the species is constantly present since then. Never the less, where present, its occurrence is disturbing, especially, the occurrence in two most important coastal wetlands along Slovenian coast - in Seÿovlje salina and Škocjan inlet representing various Natura 2000 habitats. In some years A. squamatus was found to be very abundant, even exceeding abundance of native halophile vegetation. For better predictions whether Aster squamatus, that is currently regarded as non-invasive non-native species and is already present, could benefit from global change and turn into invasive alien species we studied the species' reproductive success and micro-scale habitat properties. Results show high reproductive potential of A. squamatus and it is necessary to constrain accumulation of seeds in the soil seed bank for future invasions. According to habitat properties, especially C:N ratio, we can regard A. squamatus as an engineering species, fertilizing its own habitat. Climate change, prolonging the vegetation period, would enable more biomass accumulation followed by rapid decomposition. Released nutrients can be better used by fast-growing species that start their development slightly later in the season than early spring species, which begin to grow by

utilizing nutrients from their storage organs. In such cases of engineering alien species, adapted management is needed.

Schlumprecht, H.; Jaeschke, A.: "Constant conservation responsibilities despite variable projections of distribution areas under climate change for the green hawker (Aeshna viridis)"

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Although the importance of interactions is increasingly acknowledged, biotic interactions are rarely incorporated in biogeographic models of future species distribution under the conditions of climate change (timeframe to 2050). Here, we present the different modeling techniques (with and without incorporation of interaction) and the resulting different species distribution models for the green hawker (Aeshna viridis) and its plant for oviposition, the water soldier (Stratiotes aloides).
We compared three different approaches for incorporating biotic interactions (the dragonfly's dependence on its oviposition plant) in species distribution models.

The comparison of the projected species distribution models to the single species model of A. viridis that ignores interactions shows that all 3 approaches yielded comparable results concerning the distribution area and its potential range changes. The model that preferably uses only climate parameters of the existing distribution area of S. aloides shows differences in quality of projection. The result of all biogeographic models is range contraction (as a result of losses in the south and in the north of its current European distribution area). A spatial mismatch of the two distribution areas was not assessed as the modeling yielded a concordant change of the dragonfly and its ovipositiopn plant.

Consequences for conservation are:

Different modeling approaches lead to different distribution maps (based on the emission scenario A2, climate-model HadCM3, 2021-2050), and gains and losses occur in different countries. However, Germany remains to be responsible for the conservation of A. viridis in Europe (2 models) or Germany receives the main responsibility for the conservation of the species in Europe (1 model). The conservation status of A. viridis in Germany should be improved from the Red list status to a "favorable" status of conservation (according to the Habitats Directive).

Legal Aspects and Policy Recommendations

Biereznoj-Bazille, U.: "Nature conservation policy vs. climate change – practitioner's and environmentalist's insight into inconsistency of Polish environmental management and legislation"

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The studies showed that climate change is taking place and that mitigation efforts will limit but not prevent it. Expected increases in severe heat waves, flooding and water scarcity can all affect nature and us. Modeling and monitoring of the habitats and species conservation status are tools to predict and mitigate the negative changes in native nature resources. There is need for integrated policy approach to balance sectorial demands and manage the landscape in a sustainable way.
The aim of the presentation is to show inconsistency in Polish legislation policy basing on Biebrza Valley examples, the famous place for rare wetland fauna and flora. The research is based on analysis and practical experience in environmental management on protected area. The study was done during two years as an environmentalist in the Biebrza National Park. Three cases will be presented where the environmental damages were obvious beside the awareness of the local governments and the nature conservation authority on climate changes.
The study revealed that transposition of European legislation, as for instance The Liability Directive, is not fulfilled and that some of public investments do not follow the environmental requirements.
More insight is needed for effectiveness of transposed EU environmental legislation and its compliance with other legislation, like farming or flood protection, which mesh with nature conservation.

Ekardt, F.: "The Economics of Biodiversity and Climate Change - a (new) critical Perspective"

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This contribution presents some results from an ongoing project for the Federal German Parliament. This project analyses both the limits of cost benefit analysis of nature (and the superior ethical and legal alternatives in terms of balancing theory) and the strengths and perspectives of economic instruments of nature conservation in comparison to climate protection. The debates on monetarization and political instruments are usually conntected, but maybe exactly this is the mistake. Balancing theories are definitely relevant for defining the normative framworks and goals environmental policy, but maybe without monetarisation. On the other hand, economic instruments (but not monetarisation!) might be very promising just as political instruments of environmentalism.

Gies, M.; Albrecht, J.: "Legal Climate Change Adaptation for Natura 2000 Protected Areas:Interpretation of European Law and Comparison of Implementing National Law regarding "Adaptive Capacity of Nature Protection Law"

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The legal study analyzes the present capability for climate change adaptation measures of the nature protection legislation for Natura 2000 sites. Such adaptation measures can either be of a practical nature, or they can be purely legal. The practical measures for the management of protected sites have been identified within WP 3 of the HABIT-CHANGE Project. Legal adaptation measures are extracted from literature. The overall objective of the legal study is to make suggestions for the adaptation of the legal framework and the relevant policies with regard to climate change adaptation.
The HABIT-CHANGE Project focuses on Adaptive Management for Protected Sites. The legal study is conducted within this framework. It analyses national and European nature conservation and water law, specifically regarding its potential for guiding and controlling both practical and legal measures of climate change adaptation.

First, the regulations of European law are interpreted, focussing on the typically proposed measures of legal adaptation and adaptive management. For this purpose, the literature on legal aspects of climate change adaptation is reviewed, and typical practice examples identified within the project are tested legally. This makes it possible to evaluate where the legal constraints to climate change adaptation lie in specific cases and what is needed to improve the adaptive capacity of nature protection law or indeed of the legal system in general.

In the second step, the national nature protection regulations for Natura 2000 in the project partner countries are compared. Together with the findings from the first part, it can be evaluated which legal implementation concepts of Natura 2000 law are particularly helpful for climate change adaptation, and which on the other hand hinder targeted adaptation measures. The legal comparison thus provides a collection of "best and bad practice examples" for the adaptive capacity of national law that is implementing European Nature Protection Directives.

Last, the results are combined within a comprehensive analysis, and the outcome will be used to make recommendations for the application and adaptation of laws and guidelines on the national and on the EU-level. This makes it possible to formulate suggestions for the future development of climate change adaptive nature protection law.
- Insight in some possible effects of decentralization on nature conservation and spatial planning in the Wadden Sea Area.

Schumacher, J.: "Habitats and Birds Directive - fit for climate change?"

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The European network of protected sites is currently being challenged by anthropogenic actions and climate change. Nature conservation agencies have to cope with potential modifications of habitat composition induced by climate change and the fact that the targeted conservation practices may no longer be valid. Lacking are scenarios and indicators that can be applied on a local scale and there is also a knowledge deficit. The direction of future changes and how this lines up with the long-term impact of management measures are unclear.

The expected climatic changes (such as rising temperatures, the increase in frequency of summer drought and the higher concentration of CO2 in the atmosphere) lead to the expectation that a substantial portion of native flora and fauna including the species especially important to today's environmental protection movement will experience major changes in frequency and range in Europe. Model calculations prognosticate species loss for Europe in the area of 5 to 30 %. A purely conservation-oriented environmental protection plan that is limited to small surface areas and isolated protection areas can now no longer prevent the reduction in biodiversity. It is therefore apparent that other adaptive strategies designed by environmental protection experts are required in order to prevent the anticipated drastic loss of animal and plant species and their habitats.

All prognoses and scenarios are accompanied by a great amount of uncertainty and incalculable risks; in addition, climate change has different effects from region to region. This requires regional adaptation and opens up regional room for decision making, but also requires cooperation across national borders.

As European instruments in environmental protection the directives for bird species protection (Birds Directive) and the Habitats Directive are available. These were influenced i. a. by international regulations (Bern Convention, CBD, etc.).

Within the framework of our research project, which was funded by the Federal Agency of Nature Conservation, we have implemented the evaluation of the existing legal regulations at the European as well as the national level in order to determine to what extent these regulations are suitable for the legal application of expert environmental adaptation strategies to the problems of climate change, or which legal changes are required. This lecture focuses on the question of whether the Habitats and Birds Directive are suitable in their current form for bringing under control the consequences of climate change for the European natural heritage.

This project is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF

Monitoring of climate-induced Impacts

Fatoric, S.; Alegret, R.M.: "Vulnerability to the effects of climate change in the area of the Aiguamolls de l'Empordà, north-eastern Spain"

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Mediterranean is located at the crossroad of three continents and is one of the richest eco-regions and one of the most vulnerable natural environments in the world. Moreover, climate change is one of the most important environmental, political, and economic long term challenges facing societies, because it deals with the global sustainability dimension.

Aiguamolls de l'Empordà is one of the Spanish most vulnerable areas due to climate change effects. It is the second most important wetland area in Catalonia after the Ebro Delta and it is located in the coastal plain of the Alt Empordà, north-eastern Spain. Over the last four decades, the quality of the Aiguamolls de l'Empordà environment has been increasingly degraded by rapid urbanisation, litoralisation and various human activities, especially agriculture and tourism. These pressures generate major environmental problems expected to be exacerbated by climate change.

The environment and population in Aiguamolls de l'Empordà are facing several pressures that make them highly vulnerable, and affecting its capacity to cope with the effects of climate change. They are particularly vulnerable to four aspects of climate change: a) alterations in the magnitude, timing and frequency of rainfall, b) sea level rise, c) altered frequency and severity of extreme weather events, d) major changes in sea temperature. Increasing coastal erosion, intensification of floods, saltwater intrusion and loss of ecosystems are of particular concern for Aiguamolls de l'Empordà.

Aims of this presentation are to identify, describe, and explain the concepts of vulnerability to climate change and to provide a more holistic picture of the environmental and socioeconomic stresses, individual actions and decision making processes gained from stakeholders.

Förster, M.; Schmidt, T.; Wagner, I.; Renner, K.; Zebisch, M.; Neubert, M.: "Remote sensing methods utilized for the monitoring of habitats potentially threatened by climate change - Which indicator is derived best for which natural conditions?"

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The detection and monitoring of vegetation and habitats for nature conservation is a vital point of research within the remote sensing community. It has been agreed on that there is no general solution on deriving information on habitats due to different data availability and spectral as well as textural behaviour of habitat main types (e.g. woodlands, grasslands, etc.). Therefore, according to Vanden Borre et al. (2011) the monitoring should be rather multi-scale, versatile, user-friendly, and cost-efficient for predefined indicators.

In the presented study, five Central European test sites of natural vegetation communities in an Alpine area (1), a temperate forest (2), a Pannonian grassland (3), a shallow lake (4) and a Carpathian grassland (5) have been investigated by multitemporal remote sensing. For these studies, different time- series of RapidEye images from the years 2010 and 2011 were acquired. The amount of the images was depending on required acquisitions dates as well as weather conditions. The definition of the indicators was relying on the available ground truth data as well as the demands und judgement of the managing authorities in the nature conservation areas. The selected methods for deriving of the indicators depend on the time-series as well as the available calibration and validation data. The techniques vary between unsupervised classification, object-based approaches and supervised classification methods with algorithms such as support vector machines (e.g. SVM) or classification trees (e.g. See5). Often the named methods are utilized in combined approaches.
The resulting indicators for the monitoring are shrub encroachment (for 1), share of naturally occurring tree type (for 2), differentiation of grassland types (for 3 and 5) and the changing extent of a reed belt (for 4).
All indicators seem to be valid and useful for the authorities within the conservation areas. However, a transferability of the methods or a general statement on best-practise remote sensing applications can hardly be derived from these specific case studies. A future task would be a collection of valid remote sensing methods and indicators with their requirements regarding satellite data type and acquisition dates for more case studies.

Hanna, S.H.S.: "Ecological Footprint, Climate Change Impacts and Assessment"

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Ecological footprint is an important measure in calculating the human demands and impacts on our global environment. In this respect the ecological footprint is a function of all the parameters that interact between the power of ecosystem productivity and human interactions and activities on a particular ecosystem or the demand from that ecosystem. The present paper will cover and analyses the ecosystems productivity and the human demand from the ecosystems. It will produce comprehensive analyses in measuring the possibility of capabilities of the ecosystems to provide goods and services to the human beings on our planet earth. Further, the paper will discuss the models that can be used in measuring the sustainability of ecosystem, climate changes and what we should be doing to maintain the earth healthy ecosystems.

In this respect, the paper will assess and introduce a comprehensive model called Ecological Footprint and climate change of US (EFCHUS) that can describe the status of our ecosystems productivities and the impacts of climate change and human population on the USA earth boundaries. Furthermore the paper will provide some answers to the human issues in USA, Climate change impacts as the results of human activities. Further, warning to the current trend in use and abuse of our natural ecosystems and what will be expecting from these ecosystems to provide the human needs in response to the current use of US ecosystems exist.

Results and Conclusions

It is clear from the analysis of (EFCHUS) that the USA will reach 450 million people or more in year 2050, and this will overload the ecosystems with heavy demands and consumptions for goods and

services that these ecosystems can produce or cannot produce for the next generations. It is expected that model will assess the impacts of ecological footprint of human population in US from ecological transformation of land-use, and economic impacts, locally in US and on the global scale. From the analysis, the model predicted that the US biological capacity will be degrading to the extent that the ecosystems will not be able to support the growing populations, and there will be shortage of food and other services. It is expected that the need about twice the land of current land of US to meet the demands from our ecosystems to support the growing population. In this model, I used Stella Software to predict the impacts of ecological footprint for the next century and what we should expect beyond quantitatively. The model developed on relaxed assumption, moderate assumption and conservative assumption of human population growth and in consequence the US ecological footprint biological capacity with all its components including energy and impacts of climate change on the natural resources and availability of cycling natural resource. Accordingly, the warming and related climate changes proceed more rapidly than generally expected before. Weather extremes can cause unsustainable summer heat along with lack of water, fire causing vegetation to burn and will allow lost of forest vegetation. This will end of the destruction and loss of available food. In consequence, the famine and human death.

The paper will conclude and set up several recommendations to avoid irreversible impacts of human beings on the ecosystems and our global environment including the impact of climate change.

Nowicka, B.; Glińska, M.: "Impact of climate change on water balance of a large flow-through lake"

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In view of numerous climate scenarios showing changes in precipitation and increase of temperature it is important to assess the lake response to atmospheric forcing. The direct effect of the forecasted changes is the transformation of: water exchange conditions, water resources size and as a consequence the ecological state of the whole ecosystem (Glen, 2010). The lake sensitivity to such forcing is an individual characteristic which depends on such factors as: hydrological type of the lake (closed/flow-through/outflow), catchment area, size and shape of the basin. Research on such issues is carried out within the EuLakes Project (European Lakes Under Environmental Stressors implemented through the Central Europe Programme) which includes 8 project partners from 4 UE countries. The article presents research results which were carried out in Poland by the Institute of Meteorology and Water Management - National Research Institute (IMGW-PIB). The research is a case study of a large flow-through lake sensitivity to extreme atmospheric conditions that occured in the period of 1974-2009.
The study was conducted on the basis of Lake Charzykowskie located within Southern Pomeranian Lake District. It is a large (22-largest in Poland) dimictic flow-through lake which is fed by 4 tributaries (from 60% up to 80% of recharge). The lake covers a vast subglacial channel in which there are also two smaller lakes located below. According to Thienemann, Lake Charzykowskie is classified as transitional-mesotrophic lake type. The total catchment of lake (920 km2) is forested in 59%. Natural values of Lake Charzykowskie were the reason that lake is at the core of Tuchola Forest Biosphere Reserve since 2010. The lake is a part of the protected area of Zaborski Landscape Park (ZPK).

Since 1996, it lies in the buffer zone of the Tuchola Forest National Park (PNBT). In addition, the lake lies within the Special Protection Area for Birds „Wielki Sandr Brdy" (PLB220001; Natura 2000) and parts of the lake basin are situated in the Special Area of Conservation.

The study focused on the effects of atmospheric forcing. During the study, the changing conditions of horizontal and vertical exchange of water including water balance components were taken into account. The analysis of the effects of extreme hydrological events was carried out on the basis of IMGW measurement series made at synoptic station in Chojnice Town (located approximately 14 km from the lake) and hydrometric stations located at lake and the main tributary of Brda River (in profile above the lake and profile closing the lake gutter). The inflow of other rivers was calculated by hydrological analogy method using results of flow measurements at fixed time intervals carried out by PNBT Hydrology Department at the request of ZPK, and underground recharge calculated from balance difference.

Rainfall shortages in Lake Charzykowskie basin occurred in the early 1970s. A negative atmospheric balance has been clearly noted since 1982 and has lasted until 1997. This was reflected in fluctuations of water resources of the lake.

A decreasing tendency of water resources has been clearly noted since 1981 and has lasted until the first half of the 90s when a hydrological drought affected the whole country. The period of restoration of water resources continued until the turn of the century, when the states of surface waters reached the highest observed values within 50 years. The study showed large inertia and system resistance to atmospheric forcing.

Popov, M.A.; Sakhatsky, A.I.; Stankevich, S.A.; Kozlova, A.A.; Griesbach, R.: "The results of satellite data application for ecological state assessment in the Shatsky biosphere reserve"

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The Shatsky biosphere reserve comprises a variety of valuable habitats. The aim of the study was to assess ecological state of these habitats, as well as their sensitivity to possible climate changes. The study was conducted using RapidEye and Landsat satellite imagery.

Water balance evaluation has been carried out. Sensitive to climate changes habitats have been recognized and mapped. These are peat swamp forest, peat bogs, peat grasslands, wet/riparian meadows and sand-dunes.

Classified images combined with statistical data on plant community transpiration during growing season allowed to construct appropriate maps and make approximate calculations of a vegetation cover total water exchange within the territory. It provides a basis for overall water balance evaluation and hydrological and ecological forecasting.

Furthermore, estimations of spatial and spectral homogeneity of the most representative sites were carried out. The study was carried out in the frame of the project "Adaptive Management of Climate-induced Changes of Habitat Diversity in Protected Areas" (HABIT-CHANGE), implemented within the INTERREG IV B CENTRAL EUROPE programme. Its results will be used for recommendations for climate change adapted management of the Shatsky biosphere reserve.

Vidéki , R.; Cservenka, J.: "Landscape history researches on wetlands of special importance founding their climate adapted management plans"

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Our research was focused on discovering, analysing and assessment of long term-changes occurred in landuse, surface cover and identifiable vegetation of investigation areas have been designated in the surroundings of the settlements of Tapolca – Lesencetomaj, Nyirád and Köveskál (Balaton Uplands and Lower-Bakony, Transdanubia, Hungary). This work was supported by the „HABIT-CHANGE" Interreg IVb project aiming the preparation of climate adapted management plans.

Military (historical) maps (1st Military Survey, around 1783, 2nd Military Survey 1850, 3rd Military Survey 1883) and aerial photographs (1953; 1983; 2005-2009) prepared in different times were used to the analyses. The different landuse and surface cover types were circumscribed and represented with the same symbols on thematic maps on the above military maps and aerial photographs integrated into a unified coordinate system. After the vectorisation of surface type data referring to landuse, statistical data could be obtained for the quantification of the changes. Previous researches and monitoring data referring to the investigation areas had also been collected. Analysis of paper based data was supplemented with field examinations (actual habitat- and vegetation mapping), and with data and information gathering from local elderly inhabitants specially focusing on former landuse, origin of geographic names and vegetation types. These wide-ranging data used for the analyses represent six time series: the time around 1780, 1850, 1880, 1953, 1983 and the period between 2005 and 2009.

In the identifiable historical periods we tried to find answers for the following questions: what vegetation types might cover the investigation areas (much) earlier, how they were used or cultivated, and what was the hydrography of these remnant wetlands having outstanding importance now from the view of nature conservation. We were also interested whether - compared to meteorological data dating back to 1901 – can any impact of climate change be shown by the changes occurring in surface cover and in the identifiable vegetation, and how can we use this large amount information collected during the planning of nature conservation management.

This project is implemented through the CENTRAL EUROPE Programme co-financed by the ERDF

Poster Presentations

Davidson, S.; Wikelski, M.; Weinzierl, R.; Kays, R.; Somayeh, D.; Bohrer, G.: "Exploring how animals respond to environmental change: Linking animal movement data to global environmental datasets with Movebank"

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Developing long-term conservation strategies requires knowledge of the relationships between habitat use and environmental conditions that are affected by climate and land use changes. Identifying and quantifying these relationships often requires information about many variables that can be compared over large regions and that are available for extended periods of time. While data describing species distributions, weather parameters, and land- and sea-surface conditions are widely available, this information is provided by many sources and an ongoing challenge is simply to obtain these data and get them in a format that can be analyzed.

Movebank is a free, online database of animal tracking data that contains nearly 20,000 individual animal tracks, including more than 200 taxa. The database is open to all researchers and allows users to share, visualize, edit, analyze, and publish their data. As part of an international research collaboration through the NASA Ecological Forecasting Program Project, we now offer the ability to directly link tracking data to a growing number of global datasets, including weather parameters (NOAA and ECMWF), topography (ASTER), land cover (GlobCover), and MODIS products such as vegetation indices (NDVI) and sea-surface temperature. Users select from available animal tracks, environmental variables, and interpolation methods, and are provided with an estimate of the environmental variables for each location-time along the animal track.

Together, the tools available on Movebank can allow users to bypass many time-consuming technical challenges spend more time asking questions and analyzing relationships between animal movements and specific environmental conditions: How are foraging patterns affected by a decline in vegetation during a drought? How do movement patterns change when a habitat is urbanized?

Denoncourt, A.: "A new conservation status to strengthen ecological networks in the face of climate change: the protected area with sustainable use of natural resources"

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Climate change will enhance the biodiversity crisis which already affects the ecosystems of the planet. In 2010, reacting to this critical situation, the Secretary of the Convention on Biological Diversity, through his Aichi objectives, encouraged countries to increase their percentage of protected areas and to link and integrate those areas in larger landscapes. Doing so would facilitate a

better connectivity through the ecosystems which would permit to maintain ecological processes, habitats and species. By the same occasion, the Secretary of the Convention on Biological Diversity promoted the use of the ecological network concept to reach those connectivity objectives at a landscape scale. In practice, this connectivity could be obtained with complexes of protected areas, named «multicategory protected areas» where multi-purpose protected areas (IUCN's categories IV to VI) would protect and link conservation cores made up of strict protected areas (IUCN's categories I to III). Unfortunately, in the province of Québec, this approach would actually be difficult to implant because the use of multi-purpose protected areas status is not widespread. Consequently, there are few protected areas which could play a buffer zone or a corridor role to strengthen the ecological network to face climate change.

To study this situation, we would propose to explore these two questions: in a context of climate change, 1) how can we define a status of protected area with sustainable use of natural resources so it could play a role in the development of an ecological network which would implement an ecoregional vision for nature conservation; 2) how can we reconcile conservation and forestry on a same protected area?

To answer these questions, we proposed to use an action research approach with the use of a participative process which would include all stakeholders involved in this problematic situation. Semi-directed interviews will be realised and discussion groups (sometimes with the stakeholders, sometimes with experts) will be formed to find out what could actually be the guidelines for a status of protected area with sustainable use of natural resources and to determine what could be an appropriate forestry in a context of a multi-purpose protected area. By doing so, we hope to find out a way to preserve biodiversity in protected areas in face of climate change.

Doroftei, M.; Mierlă, M.: "Ecological Reconstruction – a management alternative for reducing climate change effects"

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Before the 90's, national politics, including Danube Delta's, was to extend economic activities by means of desiccating wetlands with a view to extend them for agriculture, forest plantations and fisheries. In time, it has been proved that agriculture within Danube Delta is not viable. Subsequently, many of these polders have been abandoned. The first ecological reconstruction of such an area was successfully carried out in 1994 within Babina-Cernovca islets. At present, it has been concluded that both renaturation of these abandoned economic areas and their reintegration within the Danube Delta natural system is a priority.

Climate-change effects have become more and more evident in this wetland's economy. Ecological reconstruction is considered a management alternative by means of these areas' integration within the touristic system as well as of habitat's rehabilitation for biodiversity. Integrated areas within Danube Delta's natural system sum up over 12,000 ha.

Our goal is to reintegrate the largest agricultural area of Danube Delta, namely Pardina polder (over 25,000 ha), which also would be the largest rehabilitated area in Europe. This area, which is confined between Chilia Branch at north and Sulina Branch at south, enclosed over 60 big and medium lakes

plus over 30 small lakes before dessication. Today it is protected by a ring of dams, being used for grazing and partially for non-mechanized agriculture. The area is under administration of Tulcea County Council and is proposed, on the basis of studies, for ecological reconstruction. Here we foresee an interest struggle between stakeholders.

Hydrological modeling indicates both that the area was strongly modified under hypsometric aspect and that the potentially floodable surface with the biggest depth is in central and south area, with no possibility to differentiate the former lakes. One of the predictable negative effects would be strong eutrophication in the first years after flooding the area. This aspect could be worse due to the pesticide used in agriculture and their retention in soil. These pesticides could migrate in the aquatic systems through the main "route" water. Reed growing will be favored by the situation, which will have the role to capture fertilizers and pesticides mechanically filter water. The process completion will result into forming new habitats for biodiversity, an economic exploitation sustainable from the perspective of reed and fish resource and touristic as well. Thus, there can be obtained a natural area with a gene bank of species out of a non-productive arid area.

Frischbier, N.; Profft, I.; Wykowski, J.: "Climate Change and consequences for Forest Habitat Types - A regional Study for the Biosphere Reserve Vessertal-Thuringian Forest within the EU funded Project HABIT-CHANGE"

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Main objectives of the project "Adaptive Management of Climate-induced Changes of Habitat Diversity in Protected Areas" (HABIT-CHANGE), implemented within the INTERREG IV B CENTRAL EUROPE programme, are:

1.) the assessment of climate change induced risks for conservation areas
2.) the development of appropriate management strategies to minimise negative effects of climate change, to facilitate adaptation processes within natural habitats and to ensure a high capacity for ecological functioning (vigor and resilience) and
3.) the development of guidelines to assist regional administrations and authorities and to facilitate the implementation of recommended management strategies.

In contrast to the project as a whole dealing with a wide range of habitat types in different central and east European regions, the main focus in Thuringia/Germany is on forest ecosystems and forest habitats of lower and medium mountain elevations in the Biosphere Reserve Vessertal-Thuringian Forest as investigation area.

Three different approaches for assessment analyses were chosen:
a.) extensive loss of tree cover on larger areas (e.g. caused by storm),
b.) small and scattered damages in forest stands and
c.) gradual changes of climate conditions.

First, a set of parameter from different evaluation schemes with criteria for habitat structure and species composition was developed. These indicators together with soil and climate specific

ecograms and climate scenario data (A1B-WETTREG) have been used for assessing and evaluating present forest habitats and potential changes during the next decades.

According to our results, longer vegetation periods in combination with reduced climatic water balance during the growing season will lead to area losses for Acidophilous Picea forests (habitat type 9410), while gains in area for Luzulo-Fagetum beech forests and Asperulo-Fagetum beech forests (habitat types 9110 & 9130) seems to be possible.

Additionally to the assessment and evaluation, management recommendations for forest conversions have been developed and discusses with regional stakeholder to improve stand structure and vitality and to avoid potential risks.

Ibisch, P.; Kreft, S., Luthardt, V.: "Strategic adaptation of nature conservation and its goals to climate change – a handbook for practitioners and decision-makers in Brandenburg (Germany)"

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On top of its destruction, fragmentation and degradation, biodiversity is increasingly stressed by climate change. This additional threat challenges current nature conservation approaches, aims and concepts, and should trigger their reconsideration. The publication "Regional Adaptation of Nature Conservation to Climate Change: Strategies and Approaches to the Conservation of Biodiversity and Ecosystem Services in the Federal State of Brandenburg (Germany)" outlines approaches to the adaptation of nature conservation goals to climate change, complemented by practice-relevant examples. With non-knowledge and uncertainties of complex systems and their future conditions being a main challenge on the regional and global scale, it is proposed to base conservation management on proactive, adaptive approaches incorporating risk management.

A climate change-adaptive alignment of conservation goals should address three overarching goals:

1. To reduce the vulnerability of biodiversity against climate change,
2. to enhance its functionality, and
3. to reduce greenhouse gas emissions from ecosystems and enhance their capacity as carbon sinks.

The handbook brings together 17 contributions by 21 authors, building on two projects at the Eberswalde University for Sustainable Development:
1. Junior Research Group "Regional Adaptation Strategy to Accelerating Climate Change – Ecosystem Services/Biodiversity" (2011-2012), funded by the European Social Fund and the Brandenburg Ministry of Science, Research and Culture, and
2. "Adaptation of Administrative Nature Conservation to Climate Change" within the joint research project "Innovation Network Climate Change Adaptation Brandenburg Berlin - INKA BB" (2009-2014), funded by the Federal Ministry of Education and Research.

The handbook is designed to prompt controversial as well as constructive discussions among practitioners and decision-makers about nature conservation and climate change. While it focuses on the Federal State of Brandenburg, the concepts, methods and strategies should be relevant and

adaptable to other regions. The volume concludes with an outline of a climate change adaptation strategy of nature conservation in Brandenburg.

Iturbide, M.; Pinto, M.; Del Hierro, O.; Butrón, A., Susaeta, I.: "Modelling bird and plant species distributions under climate change: the role of protected areas in conservation and adaptation."

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Climate change has the potential to have significant impacts on the distribution of species and on the composition of habitats. Therefore, modelling of geographic distributions of species under climate change conditions is crucial to develop conservation strategies. In this study, the potential distribution of bird and plant species of community interest have been modelled under current and future climatic conditions in the Basque Country with MAXENT (maximum entropy algorithm). Climatic variables were introduced into the model, consequently, the projections of the potential habitat obtained correspond to climatic conditions. Subsequently model outputs were imported into GIS for a posterior treatment of the results in order to incorporate other environmental variables in the definition of a more realistic habitat distribution. The area of gain, lose or maintenance of the species' potential distributions in different future times were mapped and current areas of the Natura 2000 Network were added to the maps, allowing a visual diagnosis of the adequacy of the network to guarantee the survival of the modelled species populations in a future of climate change. Results show that most species are projected to decrease in distribution and to disappear by 2080 in the Basque Country, and protected areas are not capable to neither maintain species populations nor facilitate migration to higher latitudes. Finally, adaptation measures applied to protected areas were collected.

Kenyeres, Z.; Cservenka, J.: "Climatic impacts on the grasshopper (Orthoptera) assemblages of the HABIT-CHANGE project areas (Western-Hungary)"

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Analyses of the orthopteran assemblages were carried out in Hungarian sites of HABIT-CHANGE project in 2010 and 2011. Application of grasshoppers was reasoned caused by their sensitivity to changing macro- and microclimate resulting quick modifications in their assemblage structure and outstanding latitudinal shifts in species distribution.

In the studied calcareous and Molinietum fens the grasshopper samples were collected by sweep-netting – four times per years. Microclimate measuring, including air temperature and humidity on the ground surface and at heights of 10, 20, 30 and 120 cm in the grassland, was carried out parallel with the insect-samplings. The structure of orthopteran assemblages was compared with non-metric multi-dimensional scaling. It was an advantageous circumstance that we had former data related to some of the studied orthopteran assemblages.

Our results confirmed that the grasshopper-assemblages and -species respond quickly to the climate-changes of their habitats. This dynamics is related directly mainly to the microclimate of the grasslands, indirectly to the macroclimate and land-use.

Changes in structure of the orthopteran assemblages were revealed in all the examined sites thanks for the favourable circumstance that the two studied years show robust differences in macroclimate in the study area (2010 was rainy, 2011 was droughty in the studied period). Dynamics of the orthopteran assemblages on all the sites manifests in the different contribution of subxerophitic and mesophitic species. Orthopteran assemblage of calcareous fen of the site named Köveskál–Sásdi-meadow was sampled between 2001 and 2011 seven times in another research project, so there we could analyse a longer interval. Based on this we revealed that at normal rainfall the assemblage are dominated by mesophytic, subhygrophitic and hygrophitic species, but in droughty weather contribution of subxerophitic and xerophitic species increases. Measured data of the microclimate confirmed this phenomenon, and effects of changes in land-use were also detected. We also had former orthopterological data from the Lesencetomaj–Lesencei-láprét sampling site (it was sampled between 2003 and 2011 six times). In the sampled calcareous fen a trend of drying out is seen from 2007, which manifests in the decreasing of the contribution of subxerophitic and the increasing of the contribution of mesophitic species.
We should handle these orthopterological results of HABIT-CHANGE project as an initiation. Separation of trends from the typical differences among years needs further systematic researches.

Malatinzsky, Á.; Falusi, E.; Penksza, K.; Saláta, D.; Ádám, S.: "Factors to be considered by climate smart conservation planning on lowland wet habitats"

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Several factors should be considered during the process of developing climate change adapted management on vulnerable lowland wetlands. They are presented through three sample areas of the Körös-Maros National Park (SE Hungary). Natural habitats, especially wetlands of Central and Eastern European countries are highly vulnerable to climate change. Problems reported by stakeholders as well as drivers and pressures delivered from sensitivity maps focus on those phenomena that are directly or indirectly connected to climate change. As there is strong evidence that wet habitats are becoming more sensitive and vulnerable, land users have to adapt their objectives, strategies and measures to changing climate and be involved in the process of adapting the management measures of protected areas, especially wetlands, to probable effects of climate change. Planning adaptive management should be determined by a priority row of conservation aims, i.e. which species or habitats to preserve first and foremost (e.g. birds, butterflies, orchids, other plant species, landscape view); and evaluation of factors at the determined scale of observation (e.g. habitat type or patch or protected area level). Mowing techniques, frequency and exact date should be observed as well as grazing species and their breed, due to different grazing, group forming and trampling habits. Temporary changes in species composition and habitat types due to annual effects should be handled carefully as naturalness state may be good in the altered habitat type as well, however, management action (e.g. water supply) may be necessary due to other reasons (e.g. threat of burning peat, dust storm, nesting birds).
Integrating landscape history and historical land development into the management planning process may be essential in case of lowland wetlands (e.g. watercourses before water regulatory

works or melioration). However, several limits have to be faced such as old historical maps are many times not accurate, should be handled with critics, were prepared for military and not for the use of nature sciences and management, their legend might differ in each period and studies based on literature sources and historical maps need to be combined with the examination on historical meteorological or hydrological data. A general guideline is that management planning should be based on actual (current), exact, relevant ecological and social circumstances and historical land uses.

Nouri-Fritsche, N.: "Impacts of Climate Change on Nature Tourism. A sensitivity Analysis of Nature Tourism in Müritz national park in Germany using contingent behavior approach"

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Within the climate research studies tourism is considered as a sensitive economic sector to the impacts of climate change. Different climate vulnerabilities will be identified depending on the tourism form and geographic location of the destination. Most sensitive are tourism mono-structures, destinations with mainly natural resources such as mountainous regions, coastal areas and regions with natural tourist attractions, including the protected areas. In these regions tourism potential is based on natural and environmental factors like flora, fauna and landscape, which are particularly sensitive to climate. Expected future climatic change will therefore affect the type and quality of the nature tourism and also the visitor's recreations experience.

The study consists of theoretical and empirical surveys to assess the sensitivity of tourist demand in Müritz national park affected by direct and indirect impacts of climate change.
Among various nature tourism activities I focused on two main groups. First one is "nature education", classified as indoor, second is "active tourism" including cycling, hiking and water tourism as the main outdoor activities in the region. Tourism in Müritz national park seems directly affected by climatic parameters including temperature, duration of sunshine, precipitation, extreme weather and their expected changes until the late of 21th century covering scenarios of 2071-2100. These scenarios are based on the projections of the regional climate models WETTREG and REMO concerning the reference data of 1961-1990 for the region. The indirect effects of climate change on tourism including estimated changes on flora and fauna, biodiversity, forests and water resources.
An empirical survey among the visitors is planned in autumn 2012. On the one hand will the survey assess the interaction between direct and indirect impact parameters of climate change and on the other hand "perceptions" and some „visitation behavior parameters" such as: frequency and duration of future visits and type of recreation activities applying the contingent-behavior-method.
Survey results will identify, what impacts of climate change should be considered as opportunities or threats from the perspective of nature tourism demand. These assessments provide a basis for planning current and future customer-oriented adaptation strategies for nature tourism in the Müritz national park.

Rahimi, M.; Mohammadian, N.: "Adaptation examples to Climate change impacts in Iran"

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The impacts of Climate change in different sections of natural environment of Iran have been observed, however many of them have not been studied yet and are unknown. Some of the adaptation options have conducted in Iran in order to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities in recognized areas. The most important types of adaptation in Iran are Anticipatory, Autonomous, Planned, Private, Public, and Reactive ones. Also these types of adaptation options were applied according to sector specific practices as well. Different sectors are agriculture and food security, hydrology and water resources, coastal and low lying areas, natural systems and biodiversity, human health, and human dimensions. In this study, the major methods of adaptation for climate change impacts in Iran have reviewed. However the master adaptation action plans of Iran for climate change impacts is preparing and most of these examples have used in drafting the plan.

Ricard, M.: "Assessing the vulnerability of biodiversity to climate change in protected areas of Québec, Canada"

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Climate change is now recognizes as a critical issue worldwide, threatening biodiversity along with anthropogenic land use. In northern regions such as in Québec (Canada), local biodiversity is expected to significantly increase due to the potential migration of southern species. However, disentangling the impacts of climate change represents a scientific challenge because many other factors could have a confounding influence on flora and fauna. Amongst these factors, anthropogenic activities, and more especially loss and fragmentation of natural habitats, are susceptible to increase species' vulnerability by interfering with responses to climate change, and could thus ultimately reduce ecosystems' resilience. The aim of our study was to develop an index for assessing the vulnerability of Québec's protected areas biodiversity to climate change, habitat loss and habitat fragmentation in order to provide guidelines at a regional scale for actual and future management plans, supporting conservation efforts invested in designing protected area networks. We are expecting that species inhabiting regions more affected by loss and fragmentation of natural habitats will be more vulnerable to climate change. We built a biodiversity vulnerability index to climate change using results obtained by the CC-Bio Project (http://cc-bio.uqar.ca/) when modeling ecological niche projected under different climate change scenarios. These models delineated the potential distribution of > 500 species (birds, amphibians, trees, and vascular plants). We modulated the climate change vulnerability index by including species sensitivity to natural and anthropogenic disturbances resulting in loss and fragmentation of natural habitats at the landscape scale. Doing so, we considered the synergetic impacts of these two major drivers of changes in biodiversity. Our study highlights the needs to improve management practices by increasing landscape connectivity in order to face more efficiently climate change.

Störmer, O.: "Climate change impact on dry grassland plant species and mammalian herbivory at a coastal-near cultural landscape: Presentation of our project at the "Dummersdorfer Ufer" (Schleswig-Holstein)"

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Species living in the nutrient poor and dry environment, e.g. in dry grassland plant communities, often live outside or at the edge of their biological optimum. Changes in the physical and geochemical conditions due to climate change may add further stress to the biota and disturb the balance of those sensitive ecosystems. For the northern part of Germany an increased temperature (mean: +2.9 °C) and altered precipitation patterns (decrease during the summer, increase during the winter period) by the end of the 21st century are predicted. Higher temperatures and an increased occurrence of summer droughts are likely to lead to changes in the abundance and distribution of adapted plant species. Thus, the invasion of non-indigenous, non-typical plant species might be favoured.

Dry grasslands are of high importance for nature conservation due to their unique flora and fauna. However, land-use and agricultural management changed considerably in the past. Many highly valuable biotopes of cultural landscapes (like dry grassland areas) vanished without the former land treatment. The prevention of a further loss of those landscapes containing a high biodiversity is an important task. Therefore, many cultural landscapes are under nature conservation. Grazing by large herbivores has become an established management tool to ensure the maintenance of those vulnerable biotopes. In the future the management of cultural landscapes will likely be further challenged by climate change effects. Besides effects on vegetation composition, climate change impact on the complex structure of animal-plant-interactions is another important issue for a future sustainable management of grazed cultural landscapes. Next to changes in plant chemical composition, the pollinator-plant-cycle and seed dispersal could be affected due to match-mismatch circumstances.

Our project aims to investigate the neglected dry grassland of a coastal-near cultural landscape ("Dummersdorfer Ufer", Schleswig-Holstein) towards future impacts of climate change with a focus on vegetation development and impacts on grazing herbivores. For nature conservation issues sheeps (white and grey horned heath) and goats (crossbreed of local domestic breeds) are used as management tool since 1996 in this area. In our project will focus on the following main questions:

- Are there severe impacts on the vegetation composition due to Climate Change and/or herbivory?
- Are there impacts on the chemical composition of plants due to changes of climatic conditions? Will an altered food quality affect feeding preferences of large herbivores?
- Will seed dispersal via large herbivore be affected?
- Which conclusions can be drawn from our results towards a future management of valuable natural and cultivated landscapes?

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